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THE QUALITY AND CLASSIFICATION OF SOME SLACK WATER AT DIGHA SHORE, MIDNAPUR DISTRICT, WEST BENGAL

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ABSTRACT

Slack waters at Digha, Midnapur district, West Bengal are used for irrigation in Betel cultivation. For quality of slack waters, estimations for pH, T. S. S., CO_3, HCO_3, Cl, SO_4, Ca, Mg and Na were done. These slack waters are compared with the local sea water and world average fresh water. It is inferred that these slack waters are not under the influence of sea water and can well be compared with world average fresh water. Salinity and sodium hazards are low in slack waters, as such they can be used for irrigation with advantage.

INTRODUCTION

Productive use of slack waters for the Betel cultivation at Digha attracted our attention during the ecological coastal research programme of the Midnapur coast, West Bengal. A common belief prevails that areas adjoining sea carry saline and unsuitable water for irrigation. Some ionic exchange studies interrelate sea water influence on the quality of slack water and soils. The fact that slack waters are being used for irrigation, with no deleterious effect on crop production, made us to analyse their chemical composition and codify them as per U. S. Salinity laboratory classification. Such a scientific approach will be helpful to understand the toxic sodium and salinity hazards.

GENERAL DESCRIPTION

Location and Physiography: A few representative slack water samples were collected in January, 1966 from the sand dune areas at Digha lying about half kilometer away from the sea. Elevated backshore covered with Casuarina plantation separates this undulating terrain of sand dunes from the sea. Slacks are interspersed by dunes without any direct sea water contacts. This part receives over 140 cm rainfall with a high wind velocity during April and May.

METHODS

The slack and sea water samples are analysed by the standard methods. Determinations of pH were made by Cambridge pH meter and total dissolved solids were estimated gravimetrically, A.O.A.C. (1950). Other methods adopted were by Hillebrand and Lundell (1929) for calcium; Scott (1939) for sulphate and magnesium; Jackson (1958) for carbonate, bicarbonate, chloride and sodium. Electrical conductivity in micromhos/cm was obtained by the approximated relationship to total soluble salts. Sodium absorption ratio (SAR) for sodium hazards was worked out. The diagram proposed by the U.S. Salinity laboratory (1953) for classifying irrigation water based on electrical conductivity and sodium absorption ratio was used for classification. The ionic composition of slack and sea waters in milliequivalent/litre is presented in Table I.

Observations: For quality and classificaton of slack waters analytical studies were made and results are summarised.

The chemical composition of slack waters at Digha indicates that they are alkaline in reaction, low in total soluble salts and the corresponding electrical conductivity in micromhos/cm classify all slack waters under a C_2 class indicative of a moderate salinity. Sodium absorption ratio is low and as per S.A.R. classification all slack waters fall under S_1 class, showing a low sodium content. Sodium shows slight heterogeneity in occurrence. An average composition of bases indicate no significant difference. However calcium, sodium and magnesium occur in a decreasing order. In anions sulphates and carbonates are absent, and chlorides and bicarbonates occur in low concentrations.

The sea water is alkaline in reaction with a high concentration of total soluble salts. It is an extremely saline water and has a very high sodium absorption ratio, and indicates a high sodium content. Among bases sodium is a dominent ion while magnesium and calcium are lesser in concentrations. The carbonates and bicarbonates are in traces or negligible when compared to the high contents of chlorides and sulphates.

TABLE I : *Chemical composition of some Slack Waters used for Irrigation at Digha, Midnapur District, West Bengal*

Water sample No.	Location	pH	Total Solids			Ion Concentration in Milli-equivalent/Litre								
			p.p.m	Ton ac.ft.	$Ec \times 10^6$	Ca^{++}	Mg^{++}	Na^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	$SO_4^{=}$	SAR	Class
1.	North western slack	7.7	160	0.21	250	0.60	0.40	0.28	—	0.40	0.26	—	0.40	C_2S_1
2.	Central slack	7.5	160	0.21	250	0.50	0.80	1.01	—	0.80	1.13	—	1.25	C_2S_1
3.	*South western slack-1	7.8	181	0.24	290	0.40	0.40	1.01	—	0.60	1.26	—	1.60	C_2S_1
4.	*South western slack-2	7.8	208	0.28	325	0.80	0.40	0.52	—	0.70	1.01	—	0.67	C_2S_1
5.	Northern slack	7.5	201	0.27	315	0.90	0.90	0.34	—	0.80	2.02	—	0.36	C_2S_1
	Mean	7.6	182	0.24	286	0.64	0.58	0.63	—	0.66	1.14	—	0.90	C_2S_1
6.	Sea water	7.8	22340	30.38	34882	15.50	39.40	281.00	—	2.00	287.32	100.00	53.72	C_6S_4
7.	**World average fresh water	—	—	—	—	1.49	0.42	0.36	—	1.71	0.23	0.37	0.97	S_1

*Water used for betel cultivation **Data from Conway (1942)

$$\frac{Ec \times 10^6}{100} = \frac{\text{p.p.m.}}{64}\,; \quad SAR = \frac{Na^+}{\sqrt{Ca^{++} + Mg^{++}/2}}\,;$$

C_2 = 250-750 micromhos/cm ; C_6 = above 6000 micromhos/cm.
S_1 = low sodium water ; S_4 = very high sodium water.

DISCUSSION

The quality of irrigation water primarily depends upon (i) the salt constituents and their concentration (ii) proportion of sodium to other cations (S.A.R.) and (iii) the presence of special toxic ions such as borates, chlorides, sodium or bicarbonates etc. The classification of the slack waters as per U.S. Salinity laboratory classification of irrigation waters brings out an interesting data on the quality and utility of slack waters. It can be inferred from the above results that all slack waters are of a moderate salinity and they can be used for irrigation for most crops on the sandy soils with normal soil management practises. There is a very little possibility of an increase in salinity by these waters.

Such an opinion based on total soluble salts and electrical conductivity is further supported by the sodium absorption ratio studies. It indicates a low sodium concentration and as such it can safely be used on the sandy soils with little danger of accumulation of harmful amounts of exchangeable sodium. The average composition is comparable to world average fresh water.

In addition to the above ratings certain other values of specific ion concentrations are also considered like chlorides, sodium, bicarbonates and residual carbonates. The slack water analysis shows a very low concentration of chlorides and sodium ions, thereby averts the possibility of a toxic effect like severe leaf scorch. These ions in excess of 10 e.p.m. frequently cause severe leaf scorch in fruit trees. Further observations show that these slack water contain a very low content of bicarbonates and carbonates, and residual carbonates are absent or negligible. So, the possibility of lime accumulation and increase in exchangeable sodium is least possible by such waters.

The distribution of bases in slack waters exhibit a slight heterogeneity especially in sodium. However, calcium and magnesium are persistent in their occurrence but show low concentrations due to the unequivalent ratios with the bicarbonate ions. As per classification of irrigation water in Punjab, calcium should not be less than 22 percent of the total soluble salts. Hence this aspect needs further intensive studies to suggest suitable amendments to keep the intercationic relationship at its optimum. An overall picture of sodium and calcium plus magnesium is very nicely brought out by the sodium absorption ratio studies and the inferences drawn are discussed earlier. In some cases the monovalent sodium dominance over the divalent calcium and magnesium can probably be attributed to their weak bondage with the exchangeable complex. It is an accepted fact that they are absorbed less tenaciously, released earlier, with their corresponding increase in the soil solutions. These differences are minute and may not alter the broad classification as per U.S. Salinity laboratory.

The concentrations of salts in sea water are, as expected, far in excess than slack waters. A comparative study however shows that direct pollution effects on, increase in salinity and sodium content are not seen conspicuously although they lie close to the sea. Therefore, these slacks are the natural pools of fresh waters whose composition is slightly modified by the edaphic conditions in its small millicatchments.

It can thus be generalised that the quality of these slack waters is not harmful or prohibitive in their use for irrigation. However, more investigations are necessary to explore and expand the possibilities of bringing more perennial slacks with good quality waters for use.

CONCLUSIONS

Slack waters at Digha, Midnapur district, West Bengal are analysed for their quality and classifition:

1. The electrical conductivity of slack water indicates a moderate salinity.
2. The sodium absorption ratio is very low and suggest least sodium hazards.
3. The slack waters do not contain carbonates and residual carbonates are negligible.
4. The chlorides and bicarbonates are low and are below the toxic limits.

These qualitative and quantitative characteristics of slack waters at Digha suggest that the quality of water is not harmful and can best be used for most crops with normal management practises.

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